AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

1. (Original) An apparatus for removing a shade component from an image, comprising:

calculating section for performing principle component analysis on a set of face images having various types of shades to generate an eigen space;

storing section for storing the eigen space generated by said calculating section;

input section for receiving as an input a new face image;

a1

projecting section for projecting the face image input through said input section to the eigen space stored in said storing section; and

producing section for producing a face image with shade component removed, based on the face image input through said input section and the image projected by said projecting section to the eigen space.

2. (Original) The apparatus for removing a shade component from an image according to claim 1, wherein

said calculating section includes

face component extracting section for extracting shape of each portion of each of the face images;

mean shape calculating section for calculating a mean shape for the set of said face images;

mean shape transforming section for transforming each face image to the calculated mean shape; and

principle component analyzing section for performing principle component analysis on the face images transformed to the mean shape to calculate eigen vectors to be base vectors of the eigen space.

3. (Original) The apparatus for removing a shade component from an image according to claim 2, wherein

a1

said projecting section includes

face component extracting section for extracting shape of each portion of the input face image;

mean shape transforming section for transforming the input face image to the mean shape calculated by said calculating section; and

eigen vector projecting section for projecting the face image that has been transformed to said mean shape to said eigen space.

4. (Original) The apparatus for removing a shade component from an image according to claim 3, wherein

said producing section calculates a difference component between the image projected to said eigen space and an image with shade component removed projected to said eigen space, and subtracts the difference component from the face image input through the input section, so as to produce a face image with the shade component removed.

5. (Original) The apparatus for removing a shade component from an image according to claim 4, wherein

first to third or fourth components of the image projected to said eigen space represent an image influenced by the shade component.

6. (Original) The apparatus for removing a shade component from an image according to claim 4, further comprising

a1

inverse transforming section for recovering shape of the face image produced by said producing section from the mean shape to a shape of the original face image.

7. (Original) An apparatus for removing a shade component from an image, comprising:

calculating means for performing statistical processing on a set of images having various types of shades, for calculating a prescribed image space;

storing means for storing the image space calculated by said calculating means;

input means for receiving as an input a new image;

projecting means projecting the image input through said input means to the image space stored in said storing means; and

producing means for producing an image with shade component removed, based on the image input through said input means and the image projected to the image space by said projecting means.

8. (Original) The apparatus for removing a shade component from an image according to claim 7, wherein the images having various types of shades included in said set and the image input through said input means represent subjects of the same type.

9. (Original) A method of removing a shade component from an image, comprising the steps of:

a1

performing principle component analysis on a plurality of face images having various types of shades,

said step of performing principle component analysis including the step of calculating eigen vectors and eigen values using eigen space method, regarding pixel values of face images as vectors;

forming a dictionary space having said calculated eigen vectors as base vectors;

forming a shade component removed space having a lower order component obtained by the step of performing principle component analysis as a base vector;

generating a dictionary image by applying a face image, from which shade component is to be removed, to said dictionary space;

generating a removal image by applying said face image, from which shade component is to be removed, to said shade component removed space; and

subtracting difference between said dictionary image and said removal image from said face image from which shade component is to be removed, to generate a face image with the shade component removed.

10. (Original) The method of removing a shade component from an image according to claim 9, wherein

said plurality of face images having various types of shades are images transformed to mean shapes obtained by averaging shapes of a plurality of original face images;

said face image from which shade component is to be removed is an image transformed to said mean shape;

said method further comprising the step of

performing inverse transformation of said transformation on the face image with the shade component removed, so as to recover the shape of the original face image from said face image with the shade component removed.

11. (New) A method for removing a shade component from an image, comprising:

performing principle component analysis on a set of face images having various types of shades to generate an eigen space;

storing the eigen space that is generated;

receiving as an input a new face image;

projecting the input new face image to the stored eigen space; and

producing a face image with shade component removed, based on the input new face image and the new face image projected to the stored eigen space.

12. (New) The method for removing a shade component from an image according to claim 11, wherein

performing principle component analysis includes

extracting shape of each portion of each of the face images;

calculating a mean shape for the set of said face images;

transforming each face image to the calculated mean shape; and

performing principle component analysis on the face images transformed to the mean shape to calculate eigen vectors to be base vectors of the eigen space.